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COMMUNICATIONS DEVICE FOR TRANSMITTING ACOUSTIC SIGNALS IN A MOTOR VEHICLE

The present invention relates to a communications device for transmitting acoustic signals in a motor vehicle.

Such devices, for example DVE (digital voice enhancement) systems, have the task of improving the acoustic communication between users, or the acoustic communication of users with an acoustic interface, such as a voice-recognition system or a handsfree telephone system, in a space. In addition to engine and wind noise, communication may be impeded by overly intense damping of individual, spatial, acoustic transmission routes. To this end, the devices include different microphones and loudspeakers, which are assigned to specific spatial positions. Instead of individual microphones, microphone arrays are also known, whose microphones are then aligned with the respective spatial positions.

DE 199 38 158 C1 describes a device for compensating for losses of an acoustic signal on a transmission path between at least one transmitting location and least one receiving location in a space, a control unit being provided for determining the transmission path and ascertaining at least one parameter of a corresponding transfer function, and the control unit being connected to at least one level balance, which, in combination with at least one echo compensator, is positioned between the transmitting location and the receiving location for controlling the acoustic signal level for a specifiable position in the transmission path. In this context, the microphone having the highest signal level is determined by the control unit. In each instance, this microphone represents the active microphone. Its assigned loudspeaker is deactivated. It is further proposed that the electrical signals from the active microphone to the active

loudspeakers be temporally delayed, so that these are synchronous with respect to the acoustic signal path. In addition, they should be attenuated as a function of the position of the loudspeakers, so that the sum of acoustic and electrical signals yields a predefined sound level at the specific spatial positions.

The present invention is based on the engineering problem of providing a communications device for transmitting acoustic signals, where certain interfering acoustic signals are more effectively suppressed.

The solution to the engineering problem is given by the subject matters having the features of Claim 1. Additional advantageous embodiments of the present invention are derived from the dependent claims.

To this end, the control unit is assigned at least one control element, by which at least one transmitting device may be selectively deactivated independently of the applied signal level. In this context, the present invention starts out from the knowledge that, for example, screaming children markedly deteriorate the communication between the vehicle occupants or between a vehicle occupant and terminal equipment. In specific embodiments where, in each instance, all of the transmitting devices are active, these noises are also transmitted and interfere with the acoustic perceptibility of the other vehicle occupants. In specific embodiments where, in each instance, only the transmitting device of the loudest vehicle occupant is active, this can even result in only the shouting of children being transmitted. The present invention now provides the option of selectively deactivating the corresponding transmitting device, so that acoustic signals from this spatial position are no longer transmitted by the communications device. In addition, it is also possible to weight the signal levels for selecting the active transmitting device, e.g. in order to compensate for the very loud or very

soft talking of a vehicle occupant, so that complete deactivation may optionally be dispensed with. If, for example, the signal level of the transmitting device assigned to the small child is then assigned a weighting factor of 0.1, then the transmitting device of the small child is only activated, when the signal level attenuated by 1/10 is still the highest signal level. Then, the transmission to the receiving devices preferably takes place, taking the weighting factors into consideration, so that the signals of people talking very loud are attenuated and the signals of people speaking very softly are amplified. In this context, the weighting of the signal levels may be carried out both in specific embodiments where, in each instance, only the transmitting device having the highest signal level is activated, and in specific embodiments where, in each instance, all of the transmitting devices are active.

In a further preferred embodiment, individual receiving devices may also be selectively deactivated independently of the signal levels applied to the corresponding transmitting devices. Therefore, a seating position may, for example, be completely excluded from the communications device, so that, for example, a sleeping passenger is not disturbed.

The transmitting devices preferably take the form of microphones and/or a microphone array, the receiving devices preferably taking the form of loudspeakers.

In a further preferred embodiment, only the transmitting device or microphone having the highest signal level is activated in each instance, the respectively assigned receiving device of the active transmitting device being deactivated in order to minimize feedback or echoes.

In a further preferred embodiment, time-delay elements for compensating for the propagation-time differences are positioned between the transmitting and receiving devices, in

order to emit the acoustic signal at the receiving device synchronously to the acoustic space wave. In this context, the propagation times may be determined in advance and stored in the control unit as a priori information.

In a further preferred embodiment, echo compensators are positioned between the transmitting and receiving devices, reference being made, for example, to a set-up according to DE 199 38 158 Cl.

In order to compensate for the different attenuations between the different seating positions in a motor vehicle, as well as compensate for the different attenuations as a function of the transmission direction, attenuating units are situated between the transmitting and receiving units, so that the signal levels emitted by the receiving units are adjustable in such a manner, that superposition with the acoustic space wave yields a constant signal level.

In this context, the design of the control element may vary considerably. For example, each transmitting and receiving device may be assigned a nonlocking key or switch, by which the transmitting and/or receiving device may be deactivated or further linked to the communications device. In order to reduce the number of control elements, a seating position may be assigned, in each instance, a control element, by which all of the transmitting and receiving devices assigned to the seating position may be deactivated. To dispense with separate control elements for the different seating positions, a rotary/pressure transducer, which is assigned, e.g. a display or a LED indicator, may be used, so that the seating positions may be selected by way of rotation and the transmitting and/or receiving devices of the seating positions may then be deactivated or reconnected by pressing.

In a further preferred embodiment, the communications device is operated via a multifunction operating device, where an

appropriate menu is then displayable and the transmitting and/or receiving devices are deactivated or reconnected via the control elements of the multifunction operating device, which are present as it is. In this context, the control element may take the form of a rotary/pressure transducer, rocker switch, nonlocking key, or softkey, depending on the design of the multifunction operating device.

The sole figure shows a schematic block diagram of a communications device in a motor vehicle.

Communications device 1 includes a control unit 2, a control element 3, an amplifier 4, a telephone system 5 having handsfree telephone equipment, a radio 6, four loudspeakers 7-10, as well as four microphones 11-14, which are each assigned to a seating position in the motor vehicle. Loudspeakers 7-10 are situated, for example, on the left and the right, in the front and the rear of the motor vehicle and are controlled by control unit 2 via amplifier 4, the signals of both radio 6 and telephone system 5 being able to be emitted via loudspeakers 7-10. Microphones 11-14 are assigned to different seating positions in the motor vehicle, e.g. microphone 11 being assigned to the driver, microphone 12 being assigned to the front-seat passenger, and microphones 13, 14 being assigned to the rear-seat bench (on the left and right). An acoustic signal of a vehicle occupant may then be picked up by microphones 11-14 and transmitted to control unit 2, where the signal may then be output by loudspeakers 7-10, via amplifier 4. By this means, communication between the vehicle occupants or between a vehicle occupant and terminal equipment such as telephone system 5, which would otherwise be impaired by vehicle noises or attenuation, may be improved. Therefore, using such a communications device 1, both the communication between the vehicle occupants in the front and rear of the motor vehicle is improved, and the use of handsfree telephone systems, in particular by the vehicle occupants sitting on the rear bench, is rendered possible. To

this end, control unit 2 or a measuring device assigned to it determines the microphone or the alignment of the microphone array, at which the highest signal level is currently present. In this context, only a specific frequency range may be used for determining the signal level. In so doing, it is assumed that the corresponding vehicle occupant is speaking, so that his or her signals are output via loudspeakers 7-10, while the signals of the other microphones are suppressed. In order to prevent echoes, loudspeaker 7-10 assigned to the seating position is deactivated for the voice signal, so that the vehicle occupant does not hear his own voice from the loudspeaker, while at the same time, transmitted music continues to be emitted by radio 6.

Using control element 3, which is preferably assigned to the driver, individual microphones 11-14 or groups of microphones may be deactivated. Individual loudspeakers 7-10 may be deactivated, as well. By this means, individual seating positions, whose signals transmitted by the microphones would otherwise impair or hinder communication, may be selectively excluded from the communications device, such as in the case of screaming children, whose assigned microphone would otherwise always be switched to active, given a sufficient sound level.